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THE

EIGHTH ANNUAL REPORT

OF THE

LIVERPOOL MARINE BIOLOGY COMMITTEE,

AND THEIR

BIOLOGICAL STATION AT PORT ERIN,

(Isle of Man).

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JUN 1 1915

BY

W. A. HERDMAN, D.Sc., F.R.S.,
F.L.S., F.R.S.E.,

DERBY PROFESSOR OF NATURAL HISTORY IN UNIVERSITY COLLEGE, LIVERPOOL;
CHAIRMAN OF THE LIVERPOOL MARINE BIOLOGY COMMITTEE,
AND DIRECTOR OF THE PORT ERIN STATION.

WITH PLATES AND OTHER ILLUSTRATIONS.

[*Read in part before the Liverpool Biological Society, 9th November,* 1894.]

PORT ERIN BIOLOGICAL STATION.

PRICE ONE SHILLING.

Printed by T. Dobb & Co., 229, Brownlow Hill, Liverpool.

1895.

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“ Geology and Zoology will gain much
by inquiring how our marine animals
are associated together ”—

Edward Forbes.

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v. 8

[From Trans. Biol. Soc., L'pool. Vol. IX.]

EIGHTH ANNUAL REPORT of the LIVERPOOL MARINE BIOLOGY COMMITTEE and their BIOLOGICAL STATION at PORT ERIN.

By Professor W. A. Herdman, D.Sc., F.R.S.

The work at Port Erin continues to flourish, and the investigation of the Irish Sea generally is increasing in scope. The laboratory has been well used during vacation times; there have been a considerable number of dredging expeditions, and several new lines of investigation have been started which promise well. As there is much to report upon, I shall pass at once to the usual statistical statements without further introduction; and for information in regard to the foundation and equipment of the Biological Station, and as to the aims and methods of the Committee, reference must be made to former reports.* As usual, I am indebted to several of my colleagues on the Committee and to workers at the Station for kind help which they have given me in the preparation of this annual record.

Station Record.

The following naturalists have worked at the Station during the past year:—

DATE.	NAME.	WORK.
March.	I. C. Thompson...	Copepoda.
—	W. A. Herdman	Tunicata.
—	C. H. Hurst	Collecting.

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* Copies of the Sixth Report (56 pp. and 6 plates), in stiff boards, and containing an account of the opening of the Station at Port Erin in 1892 by Governor Walpole, can still be had, price one shilling each, on application to the Hon. Treasurer.

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—	W. I. Beaumont	Nemertida.
—	F. W. Gamble	Turbellaria.
—	E. T. Browne	Medusæ.
—	Alfred Leicester	Mollusca.
—	F. E. Weiss	Algæ.
—	T. Hick	Algæ.
April.	F. E. Weiss	Algæ.
—	E. T. Browne	Medusæ.
—	W. I. Beaumont	Nemertida.
May.	E. T. Browne	Medusæ.
—	H. C. Chadwick	Synapta, &c.
—	W. A. Herdman	Tunicata.
—	I. C. Thompson	Copepoda.
June.	T. S. Lea.	Photographing Algæ.
—	Miss L. R. Thornely	Polyzoa.
—	Miss R. Alcock	Tunicata.
July.	I. C. Thompson	Copepoda.
—	A. O. Walker	Amphipoda.
—	W. A. Herdman	Tunicata.
—	W. E. Ritter, California	Tunicata.
—	A. Leicester	Mollusca.
August.	R. Hanitsch	Sponges.
—	W. A. Herdman	Tunicata.
—	I. C. Thompson	Copepoda.
—	Alf. Leicester	Mollusca.
—	T. S. Lea	Photographing Algæ.
—	Arnold T. Watson	Annelids.
—	P. M. C. Kermode	General.
—	G. W. Wood	General.
—	J. D. F. Gilchrist	Opisthobranchiata.
—	W. J. Halls	General.
September.	W. A. Herdman	General.
—	R. Hanitsch	Sponges
—	J. D. F. Gilchrist	Opisthobranchiata.
—	W. J. Halls	General.
—	I. C. Thompson	Copepoda.
—	F. T. Paul	General.
—	G. B. Howes	General.
—	R. J. Harvey Gibson	Algæ.
—	Arnold T. Watson	Annelids

Although this list is a somewhat shorter one than that in last year's record, still several of the workers stayed for long periods, and so the amount of work carried on in the laboratory this year has probably been greater than in any previous year. Some of this work will be referred to later on in the report.

Besides these workers, there were many visitors both to the Laboratory and also to the Aquarium, which seems increasing in popularity. During the season several demonstrations on the animals living in the tanks were given by the Director, and in September a special meeting of the Isle of Man Natural History Society was held at the Biological Station, when the Director gave an address on "The Exploration of Our Coasts."

THE AQUARIUM.

A full account of the arrangement of the tanks and pipes in the Aquarium-house was given in the last report. Several minor additions and improvements have been made during this year. High stands for small aquaria and glass vessels have been erected in front of the windows. The long table has been fitted with a leaden covering, with upturned edges and waste pipe, so that water spilled or leaking from aquaria may run off without wetting the wood. New wall cases and shelving have been added in the upper room for the reception of the collection of Manks Marine Invertebrates (Echinoderms, Zoophytes, Crustacea, and Mollusca) kindly presented by Mr. G. W. Wood, and other similar dried or "spirit" specimens collected in the neighbourhood. In this way the walls of the room are becoming covered with collections which form an interesting little museum of local marine zoology, and are a useful addition to the living animals in the tanks when explaining the results of our dredging investigations to visitors.

The water motor and pump are not as satisfactory as could be wished, but with a few alterations, which are now contemplated, and which can be easily carried out, we have reason to believe that the apparatus will work better. Even without the pump we have, however, the sea-water brought fresh every tide into our building by means of the pipe from the beach and our deep well, so that it is no difficult matter to keep the tanks supplied.

The Aquarium was in excellent condition during August and part of September, under the care of Dr. Hanitsch, and was open daily to visitors. The greatest number of visitors in one day was twenty-nine. With a permanent Curator, who will have fixed hours for going round with visitors and demonstrating the contents of the tanks, this department of the Biological Station will probably undergo considerable development, may form a not inconsiderable source of revenue to the institution, and will prove an additional resource and attraction to the visitors to Port Erin.

Amongst the more interesting or rarer animals which lived in the Aquarium during the summer were :—*Synapta inhærens*, *Porania pulvillus*, *Asterina gibbosa*, *Brissopsis lyrifera*, *Panthalis œrstedi*, *Calocaris macandeæ* (several individuals of this deep-sea prawn lived for some weeks; they were partly covered with fine colonies of the rare Polyzoon *Triticella boeckii*), *Ebalia tuberosa*, *Sarcodictyon catenata* (both red and yellow varieties), *Alcyonium digitatum*, *Scalpellum vulgare*.

One specimen of *Aurelia aurita* lived in a tank for over five weeks, but diminished steadily in size during the time. At the end it was about half of its original diameter, but still quite active and apparently healthy. The tank given up to Shrimps, Prawns, and Mysids proved a success, and was a great source of interest to visitors on account of the lively scenes that took place when the animals were fed. There were always a number of the ordinary shore animals, usually some beautiful vessels of brilliant anemones from the Calf Sound, sometimes jars of Copepoda and other surface organisms, while Hermit crabs,the sea-mouse, a few flat fish, brittle stars, and sea-urchins were always interesting to watch, and could readily be made to lend themselves to purposes of instruction.

Besides its distinct use to the general public, our Aquarium has another function. Several of the naturalists at work this year have made more or less use of it, and it has been felt to be a distinct aid in making several interesting original observations, such as those on *Panthalis* described further on. A number of animals spawned during spring or summer in the tanks, and an *Actinia mesembryanthemum* produced in March about 50 young anemones, which scattered themselves over the tank and throve well.

Temperature of the Sea.

As we have had no permanent resident Curator during the year, the sea temperatures have not been taken with regularity, but several of the naturalists working, who have been interested in the matter, and notably Mr. E. T. Browne in the earlier part of the summer, and Dr. Hanitsch, who acted as temporary Curator during the later part of the season, have kept daily records during the period of their stay. These are entered in the diary at the Station, and they show that, as in the case of last year's series, but not quite so markedly, the temperatures of the sea-water in gradually rising as the spring and summer advance lag slightly behind the inincreasing temperatures of the air. This summer the highest temperature (62° F., on August 21st) was ten degrees lower than the highest of last year (72° F., on August 15th), but the latter is probably to be regarded as an exceptional occurrence, in an exceptionally hot summer. It is interesting to notice that in a few of the observations taken by Mr. Browne in April, the water out in the Bay, at a depth of 3 fathoms, was about 5° F. below the surface temperature at the same time (afternoon).

Nothing has yet been done in the direction of fish hatching and lobster culture, for both of which important industries Port Erin is so eminently suitable. There are unfortunate parliamentary restrictions which at present prevent the Lancashire Sea-Fisheries Committee from spending money in this direction, upon what, from their point of view, is foreign soil. The Manks Legislature is, however, now stirring in the matter of their coast fisheries. A bill has been promoted, has passed through the House of Keys, and was lately promulgated, conferring powers, to make fishery bye-laws and other necessary regulations, upon a committee. It remains to be seen whether this committee will content itself with "restrictive" legislation, or will supplement that by the at least equally important and necessary "productive" work which leads to the encouragement and advance of fish culture and the stocking of beds and banks. Such direct action in aid of the fishing industries cannot be much longer delayed, and I am now of opinion that our Station at Port Erin should, during the coming season, be utilised for experimental work on fish hatching. Even if we cannot obtain any assistance from the Lancashire Committee, and if the Insular Government find they are unable to aid in fish production, still our L. M. B. Committee might establish one or two hatching boxes in spring, test the quality of the water by an actual experiment in hatching, and show what can be done even on a very small scale and with very limited resources.

DREDGING EXPEDITIONS.

During the year 1894 the following dredging expeditions in steamers have been arranged, partly with the help of the small Committee of the British Association alluded to in former reports. This B. A. Committee reported to the Oxford meeting of the Association, and was then re-appointed for another year, with the addition of Professor Weiss to cover the Marine Flora, and of Mr. Clement Reid to aid in working out the Geology of the floor of the sea:—

I. March 20-25th. At Easter the Committee spent some days in shore-collecting at the southern end of the Isle of Man, and hired the steam trawler "Lady Loch" for two days' dredging. On the first day the floor of the sea to the north of Port Erin from Fleshwick to Contrary Head at Peel was worked at twelve stations within four miles of the coast, and at depths from 10 to 20 fathoms. On the second day nine stations off the west of the Calf Island at depths from 20 to 25 fathoms were dredged.

March 24th. 1. West of Fleshwick Bay, a quarter mile off shore, 13 fathoms; bottom fine sand and broken shells, with* *Cliona celata*, *Gemellaria loricata*, *Canda reptans*, *Ophiura ciliaris*, *Galathea intermedia*, *Portunus arcuatus*, *Aporrhais pes-pelicani*, *Trochus magus*, *Ascidia virginea*.

2. West of Fleshwick, further north, half a mile off

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* The few species picked out for mention in each haul are not to be regarded as the rarest forms observed. In some cases they are the commonest. They are the forms which at the time seemed to us the most conspicuous and characteristic of the haul—the most noteworthy inhabitants of the ground.

shore, 15 fathoms; bottom small gravel and shells, with *Cycloporus papillosa*, *Hyas coarctatus*, *Stenorhynchus tenuirostris*, *Venus fasciata*, *Lissocardium norvegicum.*

3. West of Fleshwick, further north, half a mile off shore, 15 fathoms; bottom large shells, a little gravel, with *Pecten tigrinus*, *Venus casina*, many common crabs.

4. One mile north of Fleshwick, half a mile off shore, 14 fathoms; bottom much fine gravel, with *Pecten maximus*, *Trochus magus*, *Antedon rosacea.*

5. Off the Cronk, a mile off shore, 14 fathoms; bottom small gravel and some *Melobesia*, with *Tellina crassa* (alive), *Thracia prætenuis.*

6. One mile further north, a mile off shore, 10 fathoms; bottom Nullipores (*Melobesia* and *Lithothamnion*), with compound ascidians.

7. West from South Barrule, a mile off shore, 12 fathoms; bottom Nullipores, with *Antedon rosacea.*

8. Off Niarbyl Point a mile out (several hauls), 12 fathoms; rough hard ground, with *Antedon rosacea*, *Echinocardium flavescens.*

9. Off Glen Meay, 4 miles out, 20 fathoms; bottom "reamy" (sand and mud), with *Ophiopholis aculeata*, *Porania pulvillus.*

10. Off Glen Meay, half a mile further north, 21 fathoms, with many *Pecten opercularis*, *Cucumaria hyndmani*, *Ebalia tuberosa*, *Cellaria fistulosa*, *Scalpellum vulgare.*

11. West of Contrary Head, 4 miles off, 18 fathoms; bottom Melobesia and stones, with *Eugyra glutinans.*

12. West of Contrary Head, 1½ miles off, 13 fathoms; bottom muddy sand with some stones and many ophiuroids, with *Cliona celata* (massive form), *Astarte sulcata*, *Pecten maximus.*

II. March 25th. 1. Off Aldrick (south of Port Erin), a mile out, 18 fathoms; bottom dead shells, shell sand, and echinoderm spines, with *Spatangus purpureus*, *Echinocyamus pusillus*, *Porania pulvillus*, *Henricia sanguinolenta*, *Murex erinaceus*, *Xantho tuberculatus*.

2. Off Kitterland, 1½ miles out, 18 fathoms; bottom dead shells, with *Ascidia mentula*, *Cynthia morus*.

3. North-west of Calf Sound, 2 to 3 miles off, 19 fathoms; bottom sand and shells, with *Palmipes placenta*, *Luidea ciliaris*, *Stichaster roseus*, *Thyone fusus and T. raphanus*, *Cellaria fistulosa*, *Ascidia plebeia*, *Polycarpa comata*.

4. North-west of Calf Island, 3 miles off, 20 fathoms; bottom sand and shell fragments, with *Pectunculus glycimeris*, *Modiola modiolus*, *Pecten maximus*.

5. North-west of Burrow Rock, 3 to 4 miles off, 22 fathoms; bottom shells, with *Pectunculus glycimeris*, *Lissocardium norvegicum*, *Pecten maximus*.

6. North-west of Chicken Rock, 5 miles off, 25 fathoms; bottom dead shells and some sand, with *Sarcodictyon catenata*, *Chætopterus* sp., *Ebalia tuberosa*, *Ascidia plebeia*.

7. One-and-a-half miles off Bradda Head, 18 fathoms; bottom large shells and broken fragments, with *Asterias rubens* (very large*), *Porania pulvillus*, *Ciona intestinalis*.

8. Two to three miles N.W. of Bradda Head, 21 fathoms; bottom muddy sand, with many ophiuroids, *Cucumaria hyndmani*.

9. Four miles N.W. of Bradda Head, 23-25 fathoms (several hauls); bottom sandy mud, many ophiuroids.

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* The specimens we dredge are very much larger than those we find on the rocks of the neighbouring shore. Are there two varieties in the species, a smaller shore and a larger deep-water form, or do the individuals move outwards from the shore as they grow older?

III. May 27th. The Committee hired the steam trawler "Lady Loch," and dredged the following localities :—

1. South-east of Calf Sound, a mile from Kitterland, 20 fathoms; bottom subangular gravel (? glacial material), many ophiuroids and *Buccinum undatum*, a few large shells, *Mytilus edulis*, and *Venus casina*.

2. South-east of Calf Sound, half a mile further out, 19 fathoms; some coarse sand and broken shells, with the subangular gravel (stones much incrusted), *Spatangus purpureus*, many encrusting polyzoa, *Venus*, *Trochus*, *Pecten*, *Serpula*, *Echinus*, and *Lithothamnion* fragments.

3. South-east of Calf Sound, further on, 2 miles from Kitterland, 20 fathoms; bottom white shelly (calcareous) sand, mainly organic, lamellibranch and gastropod shells, echinoderm spines and plates, *Cellaria fistulosa* and *Cellepora pumicosa*, *Pectunculus glycimeris*, Zoophytes.

4. South-east of Spanish Head, 2½ miles off, 20 fathoms; bottom sand and broken shells; a few small stones—Triassic sandstone, slate, and pebble of felsite. Annelids, *Phyllophorus drummondi*.

5. South-east of Spanish Head, 3 miles off, 22 fathoms; bottom more shelly (fragments large), and a few small pieces of slaty rocks.

6. Off the Chasms, half a mile out, 17 fathoms; bottom muddy sand with much *Lithothamnion* and *Melobesia*, a few shells and small stones, small sub-angular fragments of slate, grit, Carboniferous limestone (with *Productus*), and pebbles of coarse sandstone.

7. Off the Chasms, a mile out, 19 fathoms; bottom mud and small gravel (subangular grit and granite), *Echinocardium cordatum* and *Echinus* remains, and some shells.

8. Off the Chasms, 2 miles out, 21 fathoms; mixed bottom, sandy mud, small subangular stones and shell fragments; with *Pagurus prideauxii* and *Adamsia palliata*.

9. South-east of the Old Mines, near Perwick Bay, quarter mile to a mile off shore, 15 to 18 fathoms (two hauls); bottom Nullipore and gravel (angular grit, slate, vein-quartz); a few shell fragments with *Ebalia tuberosa*, *Hyas coarctatus.*

10. Off mouth of Perwick Bay, half a mile off, 12 fathoms; bottom small gravel.

IV. July 8th. The Committee had the use of the Lancashire Sea Fisheries steamer "John Fell," and dredged at the following localities:—

1. West of Dalby, 5 miles out, 30 fathoms; bottom sandy mud, with *Antennularia ramosa*, *Ophiura ciliaris* and *O. albida*, *Pecten opercularis* and *P. pusio*, *Turritella terebra*, *Scalpellum vulgare*, *Hyas coarctatus*, *Eupagurus thompsoni*, *Eudorella nana*, *Gammaropsis* (? n. sp.), both the latter new to Britain, *Ascidia virginea*, and *Eugyra glutinans.*

2. Six-and-a-half miles west of Contrary Head (Peel) 38 fathoms; bottom fine mud, with *Brissopsis lyrifera*, *Lipobranchius jeffreysii*, *Eudorella nana.*

3. Seven-and-a-half miles west of Niarbyl Point, 45 fathoms; bottom fine mud, with *Calocaris macandreæ*, *Gonoplax rhomboides*, *Harpinia lævis* (new to Britain), *Panthalis oerstedi*, and fragments of a small *Lumbriconereis.*

4. Five-and-a-half miles west of Glen Meay, 34 fathoms; bottom mud, many *Turritella terebra* with *Sagartia herdmani.*

5. Four-and-a-half miles west of the Cronk, 22 fathoms; bottom broken shells and small stones, with many ophiuroids, *Stichaster roseus*, *Ebalia tuberosa*, *Eurynome aspera*, *Atelecyclus septemdentatus*, many encrusting polyzoa (twelve species identified), including *Barentsia nodosa*, hydroids (fifteen species identified), including *Dicoryne*

conferta, new to the district: also the cumacean *Campylaspis macrophthalma*, new to Britain.

V. August 19th. The Committee hired the steam trawler "Lady Loch," and dredged at the following localities:—

1. North of Calf, close in, 14 fathoms, gravel, with *Clavelina lepadiformis*, *Asterias glacialis*, many ophiuroids.

2. One-and-a-half miles north of Kitterland, 19 fathoms; stones and mud, with *Antennularia antennina* and *A. ramosa*, *Sarcodictyon catenata*, *Chætopterus* sp., *Stichaster roseus*, *Porania pulvillus*, *Ebalia tuberosa*, *Xantho tuberculatus*, *Ascidia mentula*, *A. plebeia*, *Corella parallelogramma*, *Perophora listeri*, *Forbesella tessellata*, and *Cynthia morus*.

3. Two miles west of Bradda, 23 fathoms; *Munida bamffica*, *Ascidia mentula*, *Cynthia morus*.

4. Mouth of Port Erin Bay (with small trawl), much seaweed, with *Ascidia albida* (*scabra*), several common species, such as *Pagurus bernhardus* and shrimps, some young plaice and lemon sole.

VI. August 25th. In hired steam trawler "Albatross."

1. Two miles north of the Calf, 22 fathoms; sand and Pectunculus shells and Zoophytes, with *Alcyonium digitatum*, *Sarcodictyon catenata* (yellow variety), *Campanularia verticillata*, *Chætopterus* sp.

2. Seven miles off outer end of Calf Id., 30 fathoms; dead Pectens and a few stones (up to 3 lbs.), in a little mud, with Zoophytes, *Cellaria fistulosa*, *Echinocardium flavescens*, *Echinocyamus pusillus*, *Lyonsia norvegica*.

3. Eight to nine miles west of Port Erin, 35 fathoms; bottom "reamy," with *Spatangus purpureus*, *Phascolosoma vulgare*.

4. A mile further out, 48 fathoms; mud, (containing some stones and dead shells), with *Calocaris macandreæ*,

with *Triticella boeckii*, *Panthalis oerstedi*, and *Brissopsis lyrifera*.

5. Twelve miles off, 51 fathoms; same mud and fauna.

6. Four miles west of Chicken Rock, 38 fathoms; "reamy" and shells, *Eumenis jeffreysii*, *Thyone fusus*, *Xantho tuberculatus*, *Lima elliptica*, *Pecten pusio*.

7. Three miles west of Chicken Rock, 29 fathoms; large dead shells, *Crania anomala*, *Trochus millegranus*, *Corbula gibba*, *Dentalium entale*.

8. One-and-a-half miles west of Chicken Rock, 26 fathoms; shells, sand, and gravel (general colour yellowish brown), several hauls, much material, *Solaster endeca*, many ophiuroids, *Ebalia tuberosa*, *Galathea*, *Aphrodite aculeata*, *Dentalium entale*, *Anomia ephippium*, *Pectunculus glycimeris*, *Venus casina*, and *V. gallina*, *Astarte sulcata*, *Murex erinaceus*, *Polycarpa comata*, *Ascidia mentula*, and *A. plebeia*, *Corella parallelogramma*.

9. One mile off Calf, 25 fathoms; large stones, with fine colonies of *Sertularia abietina*, *Cynthia morus*, *Saxicava rugosa* burrowing in the limestone.

10. Mouth of Port Erin Bay (small trawl); algæ, with common species of *Stenorhynchus*, *Pagurus*, *Pandalus*, *Crangon*, *Hydractinia*, *Natica*, *Lacuna*.

VII. September 30th. In hired steam trawler "Lady Loch."

1. Five hauls were taken from 7½ to 11 miles N.W. Bradda Head, 47 to 60 fathoms; mud, with *Turritella* shells, *Brissopsis lyrifera*, *Panthalis oerstedi*, *Calocaris macandeæ*, and *Triticella boeckii*. Several of the *Calocaris* were females with eggs on the abdominal appendages.

2. From 8 in to 5 miles west of Dalby and Niarbyl, about 20 fathoms; *Sarcodictyon catenata*, *Porania pulvillus*, *Palmipes placenta* (a 6 rayed specimen), *Aglaophenia tubulifera*, *Adamsia palliata*, *Scalpellum vulgare*, *Ebalia*

tuberosa, *Lyonsia norvegica*, *Lima loscombii*, *Dentalium entale*.

3. Off Fleshwick and round Bradda Head, half a mile off shore (with small trawl), 18 fathoms; algæ, with common species of *Echinus*, *Asterias*, *Solaster*, *Stenorhynchus*, *Inachus*, and *Hyas*.

It may be of some use to place on record the course of procedure at each dredging station on these expeditions. The plan for the day is arranged with the captain of the steamer, and when the first locality is reached the spot is determined on the chart, and the depth verified by casting the lead. Then the dredge (measuring 2 feet 6 inches by 1 foot, and weighing from 30 to 40 lbs.) is sent down with a tow-net tied on the line about two fathoms from the dredge. Very often a smaller dredge with a bag of cheese-cloth is sent over on the other side of the ship. One or more surface tow-nets are also put out. The tow-nets, both surface and deep, are looked after by Mr. I. C. Thompson, who, after hauling them, first turns out their contents into a clear glass jar of sea-water, and then, after noting the general character of the catch and any specially conspicuous forms, strains off the water through a small bag made of very fine miller's silk, and transfers the "plankton" left adhering to the silk into a tube containing a special preservative fluid formed of spirit, glycerine, and water.

When the dredge is brought up it is emptied on deck, and after a note of the general character of the deposit and assemblage of animals has been taken, any specially large or rare specimens are picked out and transferred to buckets or jars of sea-water, or to store-bottles of spirit Then the heap is spread out so as to form a layer not more than one or two inches in depth, and one or two members of the Committee (Professor Herdman and another) now settle down beside it to pass the entire mass in review inch by inch, working it across a small space of bare deck and turning over every shell, stone and specimen with an iron spoon, so as to ensure that nothing escapes observation and due record in the note-book. In the meantime the contents of the bottom tow-net have been dealt with by Mr. Thompson, and the apparatus has been lowered for a second haul, or the vessel is steaming on to a new locality. Then Professor Herdman selects a fair sample of the deposit for preservation (for the Geological Survey) in a small canvas bag (10 by 5 inches), care being taken to include some of the characteristic bottom animals—shells, ophiuroids, polyzoa, &c. After this sample has been removed, and any special animals required have been picked out and put into store-bottles, the whole of the remainder of the haul is passed gradually through our set of three sieves (meshes $\frac{3}{4}$ inch, $\frac{1}{4}$ inch, and $\frac{1}{8}$ inch respectively), which work up and down in a tall iron cylinder filled with sea-water. The sieves are disconnected and examined at intervals, and in this way many of the smaller animals of all groups are detected and picked out. Finally, the water in which the sieves have been plunging is all strained by Mr. Thompson through his fine silk net, and in this way many of the rarer bottom Copepoda are obtained, while the finer sandy and muddy deposits retained by the finest sieve or in the bottom of the cylinder are packed in canvas bags by Mr. Alfred Leicester for further examination at home. These contain, of course, many minute Mollusca, Ostracoda, and Foraminifera. By the time all these processes have been completed the dredge has usually been hauled again, and a fresh heap is lying on the deck awaiting investigation. On a successful trip the members of the party, on an average four to six in number, are kept constantly occupied, each man at his own work, from the commencement of the first haul till the steamer is turned homewards, and after that the packing and labelling of specimens fill up the time until land is reached.

ADDITIONS TO THE FAUNA.

As most of the expeditions took place round the Isle of Man, the material was generally brought back to the Port Erin Biological Station, and sorted out into groups in the laboratory there, and then sent to the specialists. Taking the groups in zoological order, the most notable additions as the result of this year's work have been—

SPONGES.—Dr. R. Hanitsch reports that the only actual additions to our sponge fauna made during the last few months are (1) *Leiosella* (*Spongionella*) *pulchella*, Sowerby, which was dredged on May 14th, 1894, at 14 miles N. by W. from the Liverpool N.W. Lightship. This species was previously known from the coast of Durham, the Skerries, Shetland, the west coast of Ireland, the east coast of Greenland, and the North Pacific. (2) *Myxilla irregularis*, B., found at Port Erin and Fleshwick, at low tide, in August and September, 1894. This species has previously been recorded only from the Diamond ground off Hastings. We have also found at Port St. Mary a very fine specimen of *Leucandra gossei*, consisting of at least 16 "persons," while Haeckel describes the species as having 2 to 5, rarely 4 to 8 persons.

We are indebted for a list of the HYDROID ZOOPHYTES and POLYZOA which we have collected to Miss L. R. Thornely, who has proved that the *Lafoëa pigmæa* of Alder possesses an operculum, and therefore belongs to the genus *Calycella*, and also has gonothecæ, which were previously unknown. The total number of species of hydroids in our area is now ninety, and one of the dredging expeditions has given us interesting additions to our fauna in *Dicoryne conferta*, which was growing on an *Aporrhais* shell, and was only known previously from Cullercoats, Orkney, and Shetland; and *Syncoryne eximia*, with numerous sacks or "galls" containing young Pycnogonids. Of polyzoa 123 species and 15 varieties have now been recorded. The most recent finds are *Crisia ramosa*, which was recently described by Harmer from Plymouth, and which we find also at Port Erin, and *Microporella impressa*, var. *a.*, found by Miss Thornely at Port Erin in July.

Mr. E. T. Browne has, during some visits to Port Erin, paid special attention to the MEDUSÆ, and has drawn up a list of about twenty species, one of which, at least, *Amphicodon fritillaria*, has not previously been recorded for British seas. The most interesting capture which he has made consists of several specimens of a beautiful Siphonophore, which appears to be a species of *Halistemma*, certainly new to the district and probably to the British fauna. Professor M'Intosh recorded a *Halistemma* in 1891 from St. Andrew's Bay, but our Port Erin species is not the same. Mr. Browne describes the colony as being about 25 mm. in length when expanded; it has a pneumatophore, about 6 large nectocalyces, about 4 polyps, with hydrophyllia, and long tentacles armed with clusters of nematocysts. The polypes and pneumatophore are of a deep reddish colour. The colonies were found in April, 1894.

The yellow variety (?) of *Sarcodictyon* (*Clavularia*) *catenata*, of which we dredged several colonies on August 25th, off the north-west of the Calf Is., in 22 fathoms, is an interesting addition to our fauna. It has only been found before in Loch Fyne and at two other spots on the west coast of Scotland. Some sections which I have made recently of these specimens show that the colonies were then (August) probably ready for reproduction, as the polypes contain mature ova. This is probably the *Sarcodictyon agglomeratum* of Forbes and Goodsir; a note on the subject will shortly be laid before the Biological Society.

Amongst WORMS new to the record are the Turbellaria *Fecampia* (the pear-shaped white cocoons of this form are not uncommon on stones in pools at Port Erin), and *Stylocoplana maculata* (identified by Mr. Gamble), and the annelid *Amblyosyllis* (*Gattiola*) *spectabilis* (Johnston) collected at Port Erin by Mr. Beaumont.

Professor G. S. Brady has kindly examined a number of gatherings of OSTRACODA, from dredged material, taken from 10 to over 40 fathoms, and reports the following species:—

Pontocypris trigonella, G. O. Sars; *P. mytiloides*, Norman; *P. serrulata*, G. O. S.; *Bairdia inflata*, Norman; *Cythere jonesii*, Baird; *C. tuberculata*, G. O. Sars; *C. tenera*, G. S. B.; *C. finmarchica*, G. O. S.; *C. confusa*, B. and N.; *C. concinna*, Jones; *C. dunelmensis*, Norman; *C. antiquata*, Baird; *C. emaciata*, G. S. Brady; *C. convexa*, Baird; *C. villosa*, G. O. S.; *Eucythere argus*, G. O. S. *Krithe bartonensis*, Jones; *Loxoconcha impressa*, Baird; *L. guttata*, Norman; *L. tamarindus*, Jones; *L. pusilla*, G. S. B.; *L. multifora*, Norman; *Cytherura cornuta*, G. S. Brady; *C. angulata*, G. S. B.; *C. cellulosa*, Norman; *C. striata*, G. O. Sars; *C. sella*, G. O. Sars; *Pseudocythere caudata*, G. O. Sars; *Cytheropteron latissimum*, Norman; *C. pyramidale*, G. S. B.; *C. alatum*, G. O. Sars; *Sclerochilus contortus*, Norman; *Paradoxostoma normani*, G. S. B.; *P. ensiforme*, G. S. B.; *P. variabile*, Baird; *P. hibernica*, G. S. B.; *Philomedes inter-*

puncta, Baird; *Cytheridea papillosa*, Bosquet; *C. punctillata*, G. S. B.; *Bythocythere acuta*, Norman; *B. constricta*, G. O. S.; *B. turgida*, G. O. Sars; *Machærina tenuissima*, Norman.

The common *Loxoconcha impressa* is extremely abundant sometimes on weed brought into the laboratory at Port Erin from the shore pools. About the *Cytheropteron pyramidale* noted above, Prof. Brady writes as follows:—"I find that it must be referred to *C. pyramidale*, a species of which there has been hitherto no undoubted British record. It comes very near to *C. latissimum* which, on our east coast, is a common species, but is not found on the west. In a gathering from 14 miles N. by W. of the Liverpool Lightship, *C. pyramidale* is quite the prevailing form. This is very interesting. I do not think I have seen it in any of the Isle of Man gatherings."

In regard to the COPEPODA Mr. I. C. Thompson has drawn up a general report upon the additions to our knowledge of the group (see p. 23); while Mr. Andrew Scott, "Fisheries" Assistant at University College, has supplied the following notes upon some new species of *Ectinosoma* and other Copepoda, at which he has been specially working:—

"*Longipedia minor* (T. & A. Scott).—A few specimens of this species were collected by hand-net in the rock-pools at Hilbre Island in March. It is easily distinguished from *L coronata* (Claus) by its much smaller size.

"*Ectinosoma normani*, n. sp. (T. & A. S.).—Several specimens of this *Ectinosoma* were obtained in material from Barrow Channel, collected by Professor Herdman in May, and it was also found by Mr. Thompson at Port Erin. When fresh this species has a brilliant red spot on the lower angles of the cephalothorax, and in this respect it agrees with *E. erythrops*, Brady.

"*Ectinosoma gracile*, n. sp. (T. & A. S.).—One or two specimens of this species were obtained among dredged material collected at Port Erin by Professor Herdman, Easter, 1894.

"*Ectinosoma pygmæum*, n. sp. (T. & A. S.).—This species was obtained from the same material as the last, and is the smallest *Ectinosoma* known to us; it measures only $\frac{1}{76}$ of an inch (·33 mm.)

"*Ectinosoma herdmani*, n. sp. (T. & A. S.).—One specimen of this was found by Mr. Thompson at Port Erin.

"*Bradya minor*, n. sp. (T. & A. S.).*—A few specimens of this new *Bradya* were obtained in rock-pools at Hilbre Island, along with *Longipedia minor*.

"*Dactylopus rostratus*, T. Scott.—A single specimen was obtained among some dredged material collected at Port Erin by Professor Herdman, at Easter, 1894.

"*Pseudanthessius sauvagei*, Canu.—A few specimens were obtained by washing a number of *Spatangus purpureus*, which were trawled in the central area, 21 miles W.N.W. from Morecambe Bay Lightship, on April 3rd. This rare species was only added to the British fauna last year, when it was found in the Firth of Forth, and the present is the second time it has been observed in the British area."

Lichomolgus (*Doridicola*) *agilis* (Leydig), was found in the bottom tow-net, Morecambe Bay, May, 1894. *Diosaccus propinquus* (T. & A. S.), *Ameira exigua*, T. Scott, *A. longiremis*, T. Scott, *Laophonte inopinata*, T. Scott, *Pseudowestwoodia pygmæa*, T. & A. S., and possibly a new *Laophonte*, and one or two other doubtful species were all obtained from washings from sponges collected by Dr. Hanitsch at Port Erin in August, 1894.

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* The above *Ectinosomas* and *Bradya* are figured and described in a revision of the British species of Copepoda belonging to the two genera *Ectinosoma* and *Bradya*, by T. and A. Scott, which is to be published at an early date.

Mr. Thompson reports as follows:—

"In addition to those mentioned by Mr. Scott, seven species of Copepoda, new to the district, have been recorded during the past year, viz., *Cyclops magnoctavus*, *Cyclops ewarti*, *Centropages typicus*, *Ameira longicaudata*, *Acontiophorus elongatus*, *Cancerilla tubulata*, and also one species new to science, viz., *Pseudocyclopia stephoides*, n. sp. This crustacean has just been described, and its description and figure will be shortly published in the 'Transactions of the Liverpool Biological Society.' It combines some of the characters of the genus *Stephos* with those of *Pseudocyclopia*, the latter predominating sufficiently to determine its position in that genus.

"Surface tow-nets have been continually employed during the several marine expeditions undertaken by the Committee, also tow-nets attached to the rope a few fathoms above the dredge. The latter device has proved a success, collecting some good species of Copepoda, as well as Cumacea and Amphipoda, which are seldom or never obtained on the surface. Amongst the Copepoda thus obtained were several specimens of *Pseudocalanus armatus*, found along with a shoal of *Pseudocalanus elongatus*. A widely extending shoal of *Anomalocera patersonii* was observed off the Isle of Man in May, the only occasion on which we have taken this species during the year. On several occasions during the past summer we have taken *Centropages typicus* in fair quantity, a species which has never occurred before in our district, although carefully looked for, and not a rare species elsewhere. On several occasions, notably in the early part of June the surface organisms have been singularly scarce.

"Special care has been taken to wash and sieve through fine silk as much as possible of the material brought up by the dredge during marine expeditions, and it is by this means that several of the above-mentioned Copepoda new to the district have been obtained, as well as the new species *Pseudocyclopia stephoides*. Large quantities of ophiuroids, chiefly *Ophiocoma nigra* and *Ophiothrix fragilis*, were amongst the dredged material, and it is probably from one or other of these that the two specimens of *Cancerilla tubulata*, Dalyell, a male and female, were taken, as the species is parasitic on ophiuroids. The first record of this rare copepod occurs in Dalyell's "Powers of the Creator," 1851, and it has since been taken by Mr. Gamble at Plymouth, and by Mr. Scott in the Forth, but not before in our district. *Cyclops magnoctavus*, Cragin, was found along with quantities of *Temorella affinis* and *Tachidius brevicornis* in tow-nettings taken by Mr. Ascroft in low-water marine pools at Lytham: these being brackish species, it is probable that a considerable amount of fresh-water finds its way into the Lytham pools. *Cyclops ewarti*, Brady, although first taken in the Forth estuary, was suspected by Brady to have a fresh-water origin. Ours are evidently strictly marine, two specimens, both males, having been dredged at 20 fathoms by Mr. Thompson at Port Erin."

Mr. A. O. Walker reports as follows upon the HIGHER CRUSTACEA :—"Collections have been examined from the following places, viz.—

1. Off Port Erin at various points, dredged in (usually) 10 to 50 fathoms by Professor Herdman and Mr. I. C. Thompson, in March, July, August, and September, 1894.

2. Off the Little Orme, North Wales, 5 to 10 fathoms (dredged by A. O. Walker).

3. In the Menai Straits, near the Suspension Bridge (both above and below), on April 2nd and May 31st, 1894 (dredged by A. O. Walker).

The additions made to the list published in last year's report are marked with an asterisk.

PODOPHTHALMATA.—*Gonoplax rhomboides*, Linn., one specimen on July 7th, 1894, on mud, 45 fathoms; 7 miles W. of Niarbyl, Isle of Man.

**Pisa biaculeata*, Mont., off Port Erin, Easter, 1894.

Palæmonetes varians, Leach, in a small pool by the Afonganol, Colwyn Bay, in company with *Neomysis vulgaris*. The pool had probably been filled by a combination of flood in the little river and a high tide, but seemed to have been long cut off. The pool was full of *Ruppia maritima*. The *Palæmonetes* were 40 mm. long, and females had ova in the pouches; the *Neomysis*, on the other hand, were small, females with ova being only 14 mm. long.

CUMACEA. — * *Nannastacus unguiculatus*, Bate, one specimen from Menai Straits.

**Campylaspis macrophthalma*, G. O. Sars, one female from 4½ miles west of the Cronk, July 8th, 1894, 22 fathoms. This is a Mediterranean species, new to Britain.

**Petalosarsia declivis*, Sars, 8 miles W. of Fleshwick Bay, 33 fathoms; from bottom tow-net at 14 miles N.W. of Liverpool N.W. Lightship (A. Scott). This species, first recognised in our district by Mr. Scott, is only known elsewhere in British seas from the Firth of Forth and the Moray Firth. It is therefore an addition to the west coast fauna.

**Cuma pulchella*, Sars, dredged off Little Orme, in Sept.

ISOPODA and AMPHIPODA.—*Cymodoce truncata*, Leach, off Port Erin.

**Eudorella nana* (Sars), in mud, at 30 and at 38 fathoms, West of Dalby and Peel, on July 8th, 1894 (new to Britain). This agrees with Sars' description, but a re-examination of specimens reported as *E. truncatula*, from Puffin Id., shows that the teeth on the lower anterior margin of the cephalothorax differ from both species, so that this may be a variable character. If so, *E. nana* can hardly be separated from *E. truncatula*, Bate.

**Nannonyx spinimanus*, n. sp., Menai Straits, differs from the only other known species in the following points: Anterior coxal plates about the same depth as the body; eyes very large, dark brown; propodos of first gnathopod with five or six strong denticles on the hind margin; third joint of last pereiopods but little expanded behind; maxillipedes also different.

**Socarnes erythrophthalmus*, Robertson; Port Erin, 15 to 20 fathoms, March 24th, 1894; Menai Straits.

Urothoë brevicornis, Bate; off Kitterland, 20 fms., male.

Phoxocephalus fultoni, Scott; Port Erin, 15 to 20 fathoms; Menai Straits.

**Harpinia lævis*, Sars, two specimens in mud, from 45 fathoms; 7½ miles west of Niarbyl, on July 8th (new to Britain).

**Gammaropsis* (? n. sp.), in sandy mud, from 30 fathoms, W. of Dalby, on July 8th. This is probably a new species near *G. melanops* (Sars), but differing in the form of the propodos of the first gnathopods and in the secondary appendage of the upper antennæ, which is three jointed, the last joint being minute.

Leucothoë lilljeborgii, Boeck; Port Erin, 15 to 20 fms.

**Iphimedia minuta*, Sars; Colwyn Bay, Port Erin.

Mæra batei, Norman; Port Erin.

Leptocheirus pectinatus, Norman; Port Erin, Menai Str.

Autonoe longipes, Lilljeborg; Menai Bridge.

Janassa capillata, Rathke; Port Erin.

Colomastix pusilla, Grube; Menai Straits.

Corophium bonellii, M. Edw.; Little Orme, Port Erin.

There still remains a quantity of material to be examined."

Mr. Alfred Leicester, of Southport, who has taken part in most of the expeditions, and has collected and identified the Mollusca, reports that the year's work has added fifty-one fresh records to the lists for the southern part of the Isle of Man, and that of these the following nine are new to our district of the Irish Sea:—*Cardium minimum*, Phil., *Psammobia vespertina*, Chem., *Scrobicularia nitida*, Müll., *Chiton marginatus*, Penn., *Propilidium ancyloides*, Forb., *Rissoa inconspicua*, Ald., *Cæcum trachea*, Mont., *Aclis gulsonæ*, Ch., and *Philine angulata*, Jeff.

Finally two additions have been made to our list of local fishes, viz., *Zeugopterus unimaculatus*, four specimens trawled 10—12 miles west from Morecambe Bay Lightship in May, depth 23 fathoms; and *Gobius pictus*, Malm, caught by Mr. Walker in shore pools at Colwyn Bay.

THE SUBMARINE DEPOSITS.

Turning now to the submarine deposits, the determination and distribution of which the Committee feel to be a very important part of their work, it is still too soon to attempt anything like a detailed account of the floor of the Irish Sea, but still sufficient observations have perhaps been made to warrant the following preliminary account. The accompanying chart (Plate I.) shows the zones of depths in the district, 0—10 fathoms, 10—20 fathoms, 20—50 fathoms, and upwards of 50 fathoms, being separated from one another. At those places where the Committee have obtained samples of the bottom, conventional symbols are placed on the map* indicating, ○ stones, △ shells, ▭ mud, ⊠ sand, × nullipore deposits (*Melobesia* and *Lithothamnion*), and ⧖ shell concretions. The chief conclusions we have arrived at so far are:—

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* One mark frequently stands for a number of different dredgings in the same neighbourhood.

1. The most extensive shallow-water deposit is sand. In most localities along the coast of Lancashire, Cheshire, and North Wales, from the sea-shore out to the 10-fathom contour, the bottom is formed of more or less pure quartz sand. Occasionally in spots there are local patches of stones, of shells, or of mud; but these can generally be accounted for by tidal or estuarine currents, by the entrance of fresh-water streams carrying down alluvium, or by the presence of littoral or sub-littoral boulder clay. These spots are all, however, of small area, and the great extent of the bottom down to 10 fathoms is sand.

2. Further out, however, between 10 and 20 fathoms, the sand becomes greatly mixed with mud, and much diversified by large tracts of shelly deposits or by patches of gravel, and the fauna on the bottom also becomes much more abundant. In some spots, at about 20 fathoms, it is made up over considerable areas almost entirely of ophiuroids (*Ophiocoma nigra* and *Ophiothrix fragilis*), which fill the dredge haul after haul. At two localities off the Isle of Man, viz., along the east coast from Clay Head to St. Ann's Head, and off the west coast between Contrary Head and Niarbyl, at depths between 10 and 20 fathoms, are great nullipore deposits formed of *Melobesia* and *Lithothamnion*, which have a most characteristic appearance, smell, and fauna.

This area of the sea-bottom, from 10 to 20 fathoms, extends across from the north of Lancashire to the Isle of Man, so that opposite Barrow, for example, there is a wide extent of about 50 miles in length of sea-floor at depths of not more than 15 or 16 fathoms. The Isle of Man is connected with England by this plateau, and is separated from Ireland by deep water.

3. Depths of over 20 fathoms are only found to the west, north, and south of the Isle of Man; and depths of

from 20 to 50 fathoms give us the most varied bottom deposits and the richest fauna. As a rule, the sand is more or less mixed with mud, and as the bottom goes deeper the amount of mud gets greater. When there is a considerable admixture of mud with coarse sand, that forms what is known to the trawlers as a "reamy" bottom, and that is the ground upon which the sole and some other fish are generally found spawning.

Shells and other hard parts of animals play an important part in the deposits at depths of about 20 fathoms and upwards. In places the dredge comes up filled with Pecten shells, dead and alive, chiefly *P. opercularis* and *P. maximus*. At other places the deposit is practically composed of the shells of *Pectunculus glycimeris*. These and other shell beds form a rich collecting ground to the naturalist, as they support an abundant and varied fauna. Zoophytes and polyzoa are attached to the shells, and these serve as shelter for nudibranchs and other small mollusca, worms, and ascidians. On the whole the heterogeneous deposits support a richer fauna than do the homogeneous deposits, such as sand or mud, and it is chiefly in the zone of depth we are now considering that the heterogeneous deposits occur.

4. The depths over 50 fathoms contain a pure dark bluish grey mud, which is very tenacious, and sets when dried into a firm clay. This is abominable stuff to dredge in and to work with on deck. It clings to everything that touches it; it is almost impossible to see what is in it, and to get the animals out of it uninjured; it is too solid for the sieves, and the hose can be played upon masses of it almost indefinitely without dissolving it. The fauna of this zone is, in our district, quite peculiar and characteristic. In its shallower parts, about 50 fathoms, it contains great numbers of living and dead *Turritella terebra*, upon

many of which are attached one, two, or three specimens of the little red anemone, *Sagartia herdmani*, Haddon. In its deeper parts, up to 80 fathoms, are found *Calocaris macandreœ*, *Hyalinœcia tubicola*, a small *Lumbriconereis*, *Panthalis oerstedi*, *Lipobranchius jeffreysii*, *Brissopsis lyrifera*, *Amphiura chiajii*, and *Isocardia cor.* Numbers of large sausage-like muddy tubes, formed of stratified layers of interlacing threads of mucus in which the mud particles are closely entangled, are brought up in the dredge. These we have now proved to be the tubes of *Panthalis oerstedi*, and the living annelid has several times been found in the tubes, but most of those we dredge up are empty, and the tubes are certainly far more numerous than the worms. Possibly the explanation is that the *Panthalis* forms a tube as it lies in the mud, and then when it moves away leaves its tube behind it (one can scarcely imagine the animal dragging such a tube through this tenaceous deposit), and after a time forms another in a new situation.*

These are the leading conclusions we have come to so far in regard to the distribution of sub-marine deposits in our area. Two further questions now present themselves first, the biological one—the effect upon the fauna; and secondly, the geological one—the origin of the deposits. In regard to the importance of the nature of the bottom to the animals living upon it there can be no doubt. Probably the nature of the deposit is the most important of the various factors that determine the distribution of animals over the sea-bottom within one zoological area. It is certainly more important than mere depth; a muddy bottom will support a similar fauna at 10 fathoms in one place and at 50 fathoms in another. Probably the most important influence in the environment of a lower animal is its food, and once beyond the narrow sub-littoral zone in which algæ flourish—and to which, of course, certain phytivorous animals must be restricted—it is probably chiefly the nature of the bottom which determines the food.* Many animals feed upon the deposit, others browse upon the polyzoa and zoophytes which can only attach themselves and grow where there are sufficiently large objects, such as shell valves, from which they can get the necessary stability; while others, again, feed upon their neighbours, which subsist on the deposit or are attracted by the zoophytes, &c.; for example, soles are frequently caught upon ground (known to fishermen as "sole ground") where *Flustra foliacea* lives in abundance, and the probable connection is that the fish are dependent upon the numerous amphipoda and other small animals which frequent the tufts of *Flustra.* The same locality may vary so much from time to time in the temperature, the salinity, and the transparency of the water, that it is probable that none of these factors—so long as the variations do not exceed certain limits—have so much influence upon the fauna as the nature of the deposit has. It is therefore quite to be expected that the fauna should vary from place to place with the nature of the bottom, and that is what we have observed frequently in our work round the Isle of Man. In practically the same water, identical in temperature, salinity, and transparency, at the same depth, with, so far as one can see, all the other surrounding conditions the same, the fauna varies from place to place with changes in the bottom—mud, sand, nullipores, and shell beds, all have their characteristic assemblages of animals.

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* This suggested explanation was written in June, and was read in August before Section D of the Brit. Assoc. at Oxford. The work of Mr. Watson, at Port Erin at the end of August has pretty well established its correctness, as he watched a *Panthalis*, in a tank, desert its old tube and form a new one from mucus threads and mud particles (see p. 38). It must be remembered also that some of the empty tubes doubtless belong to dead worms.

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* The only food supply quite independent of the bottom is dead plankton, from the water above, which may reach the bottom uneaten; and possibly a small amount of decayed vegetation and other organic matter brought down by rivers from the land, and some of which may reach the sea-bottom.

As to the further, and very important, question of the origin of the deposits, that is to a great extent a purely geological inquiry, and one which cannot, until we have accumulated a much larger series of observations, be fully discussed; but there are a few matters which may be briefly pointed out as giving some idea of the range and bearing of the question.

1. It is necessary to make a most careful examination of the deposits. For example, all muds are not the same in origin. A deposit of mud may be due to the presence of an eddy or a sheltered corner in which the finer particles suspended in the water are able to sink, or it may be due to the wearing away of a limestone beach, or to quantities of alluvium brought down by a stream from the land, or to the presence of a submerged bed of boulder clay, or, finally, in some places, to the sewage and refuse from coast towns.

2. I have kept in view the possibility of some correlation between the geological formations along the beach and the sub-marine deposits lying off the shore. There is no doubt that the nature of the rock forming the shore has a great influence upon the marine fauna, and has sometimes *some* effect upon the neighbouring deposits. For example, the contrast between the deposits lying off the two prominent headlands, the Great Orme, in North Wales, and Bradda Head, in the Isle of Man, is well marked. The Great Orme is composed of mountain limestone, and the result of its weathering and erosion is that large blocks

are found lying scattered outside its base on the fine sand; but there is no deposit of smaller stones, gravel, and resulting sand farther out, probably because in the wearing of the rock and large detached blocks by the sea a great deal is removed in solution and the rest in suspension as very fine mud—this we have found to be the case round Puffin Island, which is also mountain limestone. Bradda Head, on the other hand, is a schistose metamorphic silurian rock, which breaks up into large fragments, and these into smaller, and so forms deposits of dark slatey more or less angular gravel, and then very coarse sand, extending for some way out from the foot of the cliff.

The influence of the shore rocks upon the littoral fauna is an important subject upon which we have accumulated some observations; but the matter requires further work and detailed discussion, and must be left over for a future report.

3. Probably the great bulk of the silicious sand which forms so large a part of the floor of our sea is derived proximately—whatever may have been its ultimate source*—from the great deposits of drift which were formed in the neighbourhood during the Glacial period, and large tracts of which may since have been broken up by the sea.

4. As examples of a few peculiar and specially noteworthy deposits which are not simply "terrigenous" in their origin, the following may be mentioned:—

South-east of the Calf Sound, about two miles out, at a depth of 20 fathoms, there is a white shelly sand which seems to be almost wholly composed of animal remains. There are broken fragments of the lamellibranchs *Pecten*, *Anomia*, *Pectunculus*, *Mactra*, *Venus*, and *Mytilus*, of the gastropods *Cypræa*, *Buccinum*, *Emarginula*, *Purpura*, and

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[*] Probably to a great extent, Triassic sandstones.

Trochus, of various calcareous polyzoa, such as *Cellaria fistulosa*, *Cellepora pumicosa*, and lepralids, of *Balanus* and *Serpula*, and of various echinoderm plates and spines, and the whole shells of *Echinocyamus pusillus*. The deposit, when it comes up in the dredge, is of a gleaming whiteness, and has a very characteristic appearance. Such a deposit as this would form a rock almost wholly made up of fossils, and might compare well with some Tertiary fossiliferous deposits, such as the Coralline Crag.

A little further north, along the east coast of the Isle of Man, at about a corresponding depth and distance from land, we meet with a purely vegetal deposit formed of the nullipores *Lithothamnion* and *Melobesia*. On the other side of the island, again, between Port Erin and the Calf, at a depth of 18 fathoms, there is a tract of sea-bottom which, when brought up on deck, looks, at the first glance, like a peculiarly fibrous sand, but a closer examination shows that it is entirely composed of the comminuted plates, and especially the spines of echinids, chiefly *Spatangus*. I do not remember to have met with a reference to material such as this either amongst recent or fossil deposits.

The remarkable deposit of cemented shells, which was described in last year's report, from a locality half-way between the Calf and Holyhead, is also found off King William's Bank, between Ramsay and St. Bees. Plate II. represents a piece of this material.

The variety that is noticed in sub-marine deposits round the Isle of Man, from depths of 15 to 35 fathoms, as brought up in the dredge, is very striking. It is remarkable how differing proportions in the mixtures of sand, gravel, and shells give rise to very different colours and general appearance in the mass. As seen, when tumbled out of the dredge on to the deck, some deposits are white, some yellow, some grey, some reddish, of various tints from pink to ruddy brown, and others darker, of all shades of brown and dark grey. It is curious how, even in a composite deposit made up of many different constituents, there is usually a prevailing tint; for example, the bottom at one spot, although composed of mud, sand, nullipores, shells, and stones, is distinctly of a rich ruddy brown tint. The importance of this presence of prevailing colours in the various sub-marine deposits is obvious in its bearing upon the colours and habits of animals.

Sample bags of all the more important sub-marine deposits we have come upon have been sent, at Sir Archibald Geikie's request, to the Museum of the Geological Survey in Jermyn Street. They are being examined there by Mr. Clement Reid, F.G.S., who writes the following preliminary note in regard to them :—

"On comparing these samples with British deposits of Tertiary date, one finds a marked difference in lithological character. Dredgings from the Irish Sea, and also from the North Sea, are characterised by a much coarser and more gravelly texture than one would expect at such depths—coarser, in fact, than one finds in Pliocene deposits yielding a similar fauna, indicating similar or even smaller depths. A glance at these dredgings shows the reason for this, for they are largely composed of unworn or little worn fragments of rock, often entirely incrusted by organic growth. The stones evidently have not been transported far by water, or they would be well rounded, like the pebbles found in our Eocene beds. The incrusting organisms show also that the fragments have lain undisturbed on the sea-bed, yet they have often been derived from far-distant sources. Though no Glacial striæ were observed, and no undoubted sub-fossil Arctic shells have yet been found at these localities, yet there seems little doubt that the bulk of the material on the sea-bottom over this area has been derived from the breaking up of pre-existing Glacial deposits. This may occur at a depth of several fathoms through the gradual washing away of the muddy and sandy matrix of a boulder clay or Glacial gravel. Coarse gravel is thus caused to accumulate at a spot where the currents may be too feeble to transport anything but sand.

" This sub-marine origin of angular gravel deposits should not be forgotten, for it affects the lithological character of the sea-bottom over most of the area which was formerly glaciated, even as far south as Cornwall. On the other hand, it does not affect, except to a small extent, the sea-bed beyond the former limit of the ice, and it does not affect pre-Glacial deposits. Thus we must always expect to find at similar depths the same fauna associated with deposits of finer texture as soon as we leave the glaciated area, or when we go back into Tertiary times.

" It is also worth noting that the occurrence of a stony bottom at 20 or 30 fathoms—where normally there would be no deposit coarser than sand—will probably lead to a disproportionate increase of all incrusting organisms, and of all organisms needing a solid base. This has certainly taken place, as anyone studying our shoal-water Tertiary deposits will have observed. They contain few stones, and though each stone or dead shell may be covered with incrusting organisms, yet the relative proportion of these to the free forms is far smaller than seems commonly to be the case in the seas that now wash our shores. The sole exception to this rule among the British Tertiary strata is found in the Coralline Crag, in which the contemporaneous consolidation of the limestone was sufficient to provide the necessary solid base for the incrusting and fixed organisms so abundant in that deposit."

In conclusion, it is clear that this investigation of our modern sub-marine deposits, their distribution, nature, origin, and associated fauna, has geological applications, and that our results may be of some importance, *e.g.*, to palæontologists, in aiding them to determine the conditions under which the fauna of a particular horizon probably existed in the past; but, from our point of view, the matter is a purely Biological one. We consider it of primary importance, in studying the distribution of the marine animals in our district, to investigate as minutely as possible their environment, and that not merely because it gives us some of the factors and possibly the explanation of the distribution, but also on account of the light it may throw upon the habits, variations, and other important characteristics of the species.

Other Faunistic Work.

In addition to the larger dredging expeditions (see p. 9), a good deal of work has been carried on during the year from small boats in Port Erin Bay, and by shore-collecting at Port Erin, Port St. Mary, Perwick, Fleshwick, and the Calf Sound.

One interesting piece of work carried out in the Aquarium, was Mr. Arnold T. Watson's observations on the tube building of *Panthalis oerstedi*, a Polynoid worm. As is stated above (p.30), in the deep water off Port Erin we dredge in the mud large thick-walled tubes, which are sometimes associated with *Panthalis*, and which we supposed to be formed by that annelid. However, some doubt had been expressed on the matter, and a leading authority on the Annelida gave it as his opinion that the connection between *Panthalis* and the tubes had never been clearly established. Consequently, I suggested to Mr. Watson that he should come to Port Erin, obtain living specimens of the worm, and watch its habits in the Aquarium. Mr. Watson came on August 24th, and the following day we were fortunately able to take a steamer to the ground, and amongst the tubes brought up in the dredge, from over 50 fathoms, one contained a fine living *Panthalis*, which was successfully brought on shore and transferred to a small tank provided with a supply of the fine mud in which the animal lives. The worm was then kept under the closest observation by Mr. Watson during the whole day for the next week, and his enthusiasm and patient care have been rewarded by the collection of a number of drawings and notes and some photographs of the appearance and movements of the living animal. During that time the *Panthalis deserted its old tube and formed a new one in the mud*, fortunately using the glass for part of one side, so that the process of scooping out, the mud and of spinning the network of mucus threads and the various movements of the animal were readily enough seen—if one did not mind the inconvenience of lying for hours in a cramped position on the damp concrete floor of the Aquarium-room. This satisfactorily settled the *Panthalis* question, and established the correctness of our previous views as to the connection between the worm and the empty tubes brought up in the dredge.

Rev. T. S. Lea, M.A., on two visits to the Station, spent some time in taking photographs of characteristic specimens of the Marine Algæ *in situ* at low tide, and in making microphotographs in the laboratory. He also photographed some of our collecting grounds and pools, and some selected pieces of rock showing assemblages of animals and plants in their natural environment.

We have again been able to send specimens of the large red mite *Bdella basteri* to Mr. Michael to aid in his work on the Acarina. We have found the home of this species to be deep in the cracks and fissures of the cliffs round the Biological Station. From these holes the mites occasionally emerge in numbers, and are then found over the shore and on our concrete steps.

Mr. Chadwick made a special study of the plankton of Port Erin Bay during part of May, and collected a large amount of material, which is not yet fully examined. He found, amongst other things, various stages in the life history of *Amphicodon fritillaria*, post larval stages of *Polynoe*, *Terebella*, and *Pectinaria*, and also the *Halistemma*-like Siphonophore, which had been found by Mr. E. T. Browne in April.

Professor Weiss was at work during the spring at Port Erin, on Marine Botany. In part he was investigating the effect of different coloured lights on various living sea-weeds. He did not arrive at any definite result, but intends to pursue the matter further. He also spent some time in examining living Diatoms, with a view to clearing up some imperfectly known particulars in their life history. This work is also not yet completed.

Miss L. R. Thornely and Miss R. Alcock worked together at the Station for some time in June. Miss Thornely was occupied with the collection and determination of Polyzoa, and Miss Alcock was preserving material for investigations on the microchemistry of the tests of Tunicata.

In September we obtained some specimens of *Calocaris* with ova on the abdomen. The ova are of a pale red colour, and of relatively large size, measuring about 1·5 to 2 mm. in diameter in a specimen about 5 cm. long. There are from 45 to 60 ova on each individual. It is interesting to compare these measurements with those of the common shrimp, where an individual 7 cm. long may have about

5000 ova, measuring each about 0·7 mm. in diameter. So that in the *Calocaris* the ova are about three times as large, but not nearly so numerous, as in the case of its shallow water relation.

THE "DRIFT BOTTLES."

In connection with the investigation of the surface life, in discussing the appearance and disappearance of swarms of certain Copepods and Medusæ, and in considering the possible influence of the movements of food matters upon the migrations of fishes, it has occurred to several of us at different times during the last few years, that it would be worth while to try to ascertain the set of the chief currents, tidal* or otherwise, such as the movement of surface waters caused by prevalent winds. The Prince of Monaco started a few years ago the system of distributing over the North Atlantic large numbers of small floating copper vessels, with the object of finding out where they drifted to. This plan we have adopted, with slight modifications. In September I selected a small, strong, buoyant bottle, measuring 7·5 cm. by 1·8 cm., which seemed well suited for the purpose, and which costs only 7s. per gross. I drew up a notice, as follows, to go in the bottles, and had a large number printed and numbered consecutively:—

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* The tidal currents of the district are already to some extent known, and are marked in the charts and given in books of sailing directions, as Admiral Beechey's "Tidal Streams of the Irish Sea;" but we desire to ascertain the resultant currents from all influences which would affect the drift of small floating bodies.

Any one who finds this is earnestly requested to write the place, and date when found, in the space (on the other side) for the purpose, place the paper in an envelope, and post it to

PROFESSOR HERDMAN,
University College,
LIVERPOOL.

Postage need not be prepaid.

No.......

[Turn over.

[OTHER SIDE.]

Please write distinctly, and give full particulars.

LOCALITY, where found ....

....

....

DATE, when found.......................................

Name and address of sender.

....

....

A paper was then placed in each bottle, so folded that the number could be readily seen through the glass, the cork was well pressed down, and dipped in melted paraffin. Nearly two hundred of these bottles have, since September 30th, been dropped into the sea in various parts of our area, a record being kept of the locality and time when each was set free. Several dozen were let off from the Isle of Man steamer in crossing to Douglas and back, at intervals of quarter of an hour, and from our trawler when dredging between Port Erin and Ireland. Several dozen have been let off from Mr. Alfred Holt's steamers in going round to Holyhead and in coming down from Greenock. The fishery steamer "John Fell" has distributed a number along the coast in the northern part of the district, and others have been set free at stated intervals during the rise and fall of the tide from the Morecambe Bay Light Vessel, and from the Liverpool North-west Light Vessel. Altogether, over 30 per cent., or nearly one in three of the bottles distributed have been subsequently picked up on the shore and returned to me. They come from various parts of the coast of the Irish Sea—Scotland, England, Wales, Isle of Man, and Ireland. Some of the bottles have gone quite a short distance, having evidently been taken straight ashore by the rising tide. Others have been carried an unexpected length, *e.g.*, one (No. 35), set free near the Crosby Light Vessel, off Liverpool, at 12-30 p.m., on October 1st, was picked up at Saltcoats in Ayrshire, on November 7th, having travelled a distance of at least 180 miles* in 37 days; another (H. 20) was set free near the Skerries, Anglesey, on October 6th, and was picked up one mile N. of Ardrossan, on November 7th, having travelled 150 miles in 31 days; and bottle No. 1, set free at the Liverpool Bar, on September 30th, was picked up at Shiskin, Arran, about 165 miles off, on November 12th. On the other hand, a bottle (J. F. 34), set free on November 7th, at the Ribble Estuary, was picked up on November 12th at St. Anne's, having gone only 4 miles.

It would be premature as yet—until many more dozens or hundreds have been distributed and returned—to draw any conclusions. It is only by the evidence of large numbers that the vitiating effect of exceptional circumstances, such as an unusual gale, can be eliminated. Prevailing winds, on the other hand, such as would usually affect the drift of surface organisms are amongst the normally acting causes which we are trying to ascertain. I may state, however, that so far nearly 50 per cent. of the bottles found had been carried to Ireland, and they are chiefly ones that had been set free in the southern part of the district (between Liverpool and Holyhead) and off the Isle of Man. The bottles set free along the Lancashire Coast and in Morecambe Bay seem chiefly to have been carried to the south and west, *e.g.*, to about Mostyn, in North Wales, and Douglas, Isle of Man. It is only a few exceptional ones so far that have been carried out of our area through the North Channel.

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* More probably, very much further, as during that time it would certainly be carried backwards and forwards by the tide.

Plate I. shows by the dark dashes the lines along which the drift bottles have been set free, and the arrow heads give some idea of the direction which some of the bottles have apparently taken.

Publications.

Sufficient material has now been accumulated to form a new volume of the "Fauna of Liverpool Bay." Consequently, Volume IV. will be issued early in 1895, and will contain, in addition to the reports and papers which were mentioned last year as printed off, the Supplementary Report on the Hydroid Zoophytes, by Miss L. R. Thornely; a list of the Nemertida found at Port Erin, by Messrs. Beaumont and Vanstone; a Revision of the Nomenclature and Classification of British Sponges, by Dr. Hanitsch; a Report on the Fishes of the District, by Professor Herdman; a paper on *Synapta*, by Mr. Chadwick, and one on the Tube-building Habits of *Panthalis*, by Mr. Watson; a report on the L. M. B. C. Medusæ, by Mr. Edw. T. Browne; and a Supplementary Report on Copepoda, by Mr. I. C. Thompson.

It has been suggested that a general index should now be drawn up to the species recorded in the volumes on the Fauna and Flora of Liverpool Bay. There can be no doubt that such an index would be useful, and will eventually be necessary, but as the work of identifying species is still in active progress, and fresh records are being made annually, it is perhaps a little premature to undertake such a piece of work now. Probably an appropriate time for the compilation of such an index would be at the conclusion of the labours of our British Association Committee, which will probably submit its final report on the occasion of the visit of the British Association to Liverpool in the autumn of 1896.

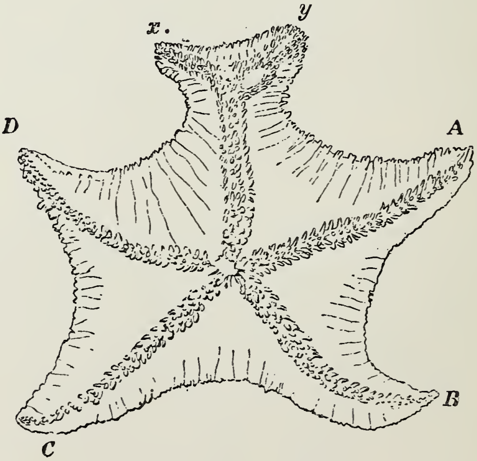
The surplus copies of the five Annual Reports upon the Marine Biological Station formerly on Puffin Island (1888 to 1892, the complete set) have been collated and bound up to form an 8vo. volume of about 180 pages, illustrated with cuts and plates, and containing the original lithographed covers. There are 20 copies of this vol. which are now offered by the Committee at 3s. each nett (post free); apply to Mr. I. C. Thompson, 4, Lord Street, or to Prof. Herdman, University College.

Future Work.

During the coming year the Committee propose, in the course of their dredging, trawling, and tow-netting investigations, to pay special attention to the nature of the sea-bottom and to the assemblages of animals and plants found on particular deposits. They hope, with the co-operation of Mr. Clement Reid, and of any local Geologists who will help them, to work up more thoroughly the Geology of the sea-bottom, and so attempt the solution of that interesting problem, the date and circumstances of formation of the Irish Sea and of the separation of the Isle of Man from England. They propose also to continue for at least a year the observations on currents by means of "drift bottles," and would be glad of any assistance in this from shipowners and captains, especially in distributing bottles along lines crossing the northern and southern entrances to the Irish Sea, such as from Port Patrick to Belfast, or from Belfast to Whitehaven, and from Holyhead to Dublin, or thereabouts.

A further subject upon which the Committee are very desirous of doing some work is sea-fish hatching and fish culture. That, however, is a somewhat expensive matter, requiring special arrangements and apparatus. If the various County Councils and Fishery Boards having jurisdiction over the territorial waters of the Irish Sea, could see their way to unite in promoting a Fish Hatchery at Port Erin, it would be a benefit to the whole sea-district. This northern area of the Irish Sea, in the centre of which the Isle of Man lies, is a natural fishery district, with its own spawning grounds, "nurseries," feeding grounds, and important fishing industries. The same bye-laws ought to apply throughout the area, and there ought to be a central fish hatching and rearing establishment in some convenient spot where the water is the purest obtainable and as free as possible from all suspended matters. Such a hatchery would not be for the benefit of Lancashire alone, nor of Cheshire, nor of the Isle of Man, but would benefit the fish population of the entire area, and the fisheries in general. The L. M. B. C., although very willing to advise, to co-operate, and to supervise if desired, cannot be expected unaided to carry out such an extensive scheme; but even if they receive no outside assistance, they are determined to start the matter by conducting some experiments in hatching during the coming spawning season, so as to demonstrate the suitability or otherwise of Port Erin for this purpose. In this connection the Hon. Treasurer begs to call attention to the fact that his small balance in hand will very soon be exhausted in making the necessary preparations for these experiments, and that he would be very glad to receive subscriptions for this or any other of the special purposes mentioned above.

The usual statement of the Hon. Treasurer, and the the list of subscriptions and donations for 1894 is appended to this Report.



An abnormal specimen of *Porania pulvillus*, where one of the rays shows a tendency to branch dichotomously. *A*, *B*, *C*, *D* are normal rays, while the fifth ray has divided into x and y, the latter of which has split and partially united at least twice. The specimen is in the Zoological Museum of University College, Liverpool. (For the use of this block we are indebted to the courtesy of Messrs. Macmillan & Co.)

APPENDIX.

SUBSCRIPTIONS and DONATIONS.

	Subscriptions.			Donations.		
	£	s.	d.	£	s.	d.
Alcock, Miss, Cambridge	0	10	0		—	
Banks, Prof. W. Mitchell, 28, Rodney-st.	2	2	0		—	
Beaumont, W. I., Cambridge	1	1	0		—	
Bickersteth, Dr., 2, Rodney-street	2	2	0		—	
Boulnois, H. P., 7, Devonshire-road, Prince's Park	1	1		--		
Brown, Prof. J. Campbell, University College, Liverpool	1	1	0		—	
Browne, Edward T., B.A., 14, Uxbridge road, Shepherd's Bush, London	1	1	0		—	
Caine, Nath., 10, Orange-court, Castle-street	1	1	0		—	
Caton, Dr., 31, Rodney-street		—		1	1	0
Clague, Dr., Castletown, Isle of Man	1	1	0		—	
Clague, Thomas, Bellevue Hotel, Port Erin	1	1	0		—	
Comber, Thomas, J.P., Leighton, Parkgate	1	1	0		—	
Crellin, John C., J.P., Ballachurry, Andreas, Isle of Man	1	1	0		—	
Dawkins, Professor W. Boyd, Owens College, Manchester	1	1	0		—	
Denny, Prof., Firth College, Sheffield	1	1	0		—	
Derby, Earl of, Knowsley	5	0	0		—	
Gair, H. W., Smithdown-road, Wavertree	2	2	0		—	
Gamble, Col. David, C.B., Windlehurst St. Helens	2	0	0		—	
Gamble, F. W., Owens College, Manchester	1	1	0		—	
Gaskell, Frank, Woolton Wood,	1	1	0		—	
Gaskell, Holbrook, J.P., Woolton Wood,	1	1	0		—	
Gell, James S., High Bailiff of Castletown	1	1	0		—	

Gibbons, Fredk., 19, Ranelagh-street ...	1	1	0	—
Gibson, Prof. R. J. H., 41, Sydenham-avenue	1	1	0	—
Gifford, J., Whitehouse terrace, Edinburgh	1	0	0	—
Glynn, Dr., 62, Rodney-street	1	1	0	—
Greening, Linnæus, 5, Wilson Patten-street, Warrington	1	1	0	—
Hall, Walter J., Lindum House, Nantwich	0	10	0	—
Halls, W. J , 35, Lord-street	1	1	0	—
Henderson, W. G., Liverpool Union Bank	1	1	0	—
Herdman, Prof., University College, L'pool.	2	2	0	—
Hick, Herbert E., M.R.C.S., Southport House, Bradford	0	10	6	—
Hick, Thomas, B.A., Brighton-grove, Rusholme, Manchester	0	10	6	—
Holder, Thos., 1, Clarendon-buildings Tithebarn-street	1	1	0	—
Holland, Walter, Mossley Hill-road ...	2	2	0	—
Holt, George, J.P. Sudley, Mossley Hill ...	1	0	0	—
Howes, Prof. G. B., Royal College of Science, South Kensington, London...	1	1	0	—
Hoyle, W. E., Museum, Owens College, Manchester	1	1	0	—
Isle of Man Natural History and Antiquarian Society	1	1	0	—
Jones, C. W., J.P., Field House, Wavertree	1	0	0	—
Kermode, P. M. C., Hill-side, Ramsey ...	1	1	0	—
Lea, Rev. T. Simcox, 3, Wellington-fields	1	1	0	—
Leicester, Alfred, 30, Weld-rd., Birkdale...	1	1	0	—
Lomas, J., Amery-grove, Birkenhead ...	1	1	0	—
Macfie, Robert, Airds	1	0	0	—
Meyer, Dr. Kuno, University College, L'pool	0	5	0	—
Meade-King, H. W., J.P., Sandfield Park	1	1	0	—
Meade-King, R. R., 4, Oldhall-street ...	0	10	0	—
Melly, W. R., 90, Chatham-street... ...	1	1	0	—
Miall, Prof., Yorkshire College, Leeds ...	1	1	0	—
Monks, F. W., Brooklands, Warrington ...	1	1	0	—

Muspratt, E. K., Seaforth Hall	5	0	0		—	
Newton, John, M.R.C.S., 44, Rodney-street	0	10	6		—	
Odgers, Rev. J. E., Woodstock Rd., Oxford	1	1	0		—	
Poole, Sir James, Tower Buildings	2	2	0		—	
Rathbone, S. G., Croxteth-drive, Sefton-park	2	2	0		—	
Rathbone, Mrs. Theo., Backwood, Neston	1	1	0		—	
Rathbone, Miss May, Backwood, Neston	1	1	0		—	
Rathbone, W., M.P., Greenbank, Allerton	2	2	0		—	
Reading, N. C., Wake Green-road, Moseley	0	10	6		—	
Roberts, Isaac, F.R.S., Tunbridge-wells	1	1	0			
Shaw, Prof. H. S. Hele, 26, Waverley-road	1	1	0		—	
Shepheard, T., Kingsley Lodge, Chester	1	1	0		—	
Simpson, J. Hope, Annandale, Aigburth-drive	2	2	0		—	
Smith, A. T., junr., 24, King-street	1	1	0		—	
Stevenson, W. A., Ballakreighan, Castletown, Isle of Man	1	1	0		—	
Talbot, Rev. T. U., 4, Osborne terrace, Douglas, Isle of Man	1	1	0		—	
Thompson, Isaac C., 19, Waverley-road	2	2	0		—	
Thornely, James, Baycliff, Woolton	1	1	0		—	
Thornely, The Misses, Baycliff, Woolton	1	1	0		—	
Toll, J. M., 340, Walton Breck-road	1	1	0		—	
Tomlin, B., 59, Liverpool-road, Chester	0	5	0		—	
Walker, Alfred O., Nant-y-glyn, Colwyn Bay	3	3	0		—	
Walker, Horace, South Lodge, Princes-park	1	1	0		—	
Walters, Rev. Frank, B.A., King William College, Isle of Man	1	1	0		—	
Watson, A. T., Tapton-crescent, Sheffield	1	1	0		—	
Weiss, Prof. F. E., Owen's College, Manchester	1	1	0		—	
Westminster, Duke of, Eaton Hall	5	0	0		—	
Wiglesworth, Dr., Rainhill	1	1	0		—	
	101	15	0	1	1	0

THE LIVERPOOL MARINE BIOLOGY COMMITTEE.

Dr. IN ACCOUNT WITH ISAAC C. THOMPSON, HON. TREASURER. **Cr.**

1894.	£	s	d.
To Balance due Treasurer, 1893	46	14	2
,, Expenses of Dredging Expeditions	31	11	8
,, Rent of Port Erin Biological Station and Aquarium	15	0	0
,, Boat Hire	4	0	9
,, Apparatus, Furniture, Books, &c., at Port Erin Biological Station	13	19	4
,, Printing, Dobb & Co, Reports, &c., &c	22	10	6
,, Postages, Carriage of Apparatus, &c	3	5	6
,, Sundries	5	2	1
,, Salaries to temporary Curator. and laboratory boy	20	19	0
,, Balance in hand	3	6	2
	£166	9	2

1894.	£	s.	d.
By Subscriptions and Donations	101	15	0
,, Royal Society Grant	50	0	0
,, Dividend, British Workman's Public House Co., Ltd., Shares	4	2	7
,, Sale of Reports	5	17	6
,, Bank Interest	1	10	2
,, Sale of Museum Specimens	0	14	1
,, Admissions to Aquarium (Port Erin)	2	9	10
	£166	9	2
Endowment Fund Investment :—			
Brit. Workman's Public House Co.'s Shares	173	1	0
Cash pending Investment	7	10	0
	£180	11	0

ISAAC C. THOMPSON,
HON. TREASURER.

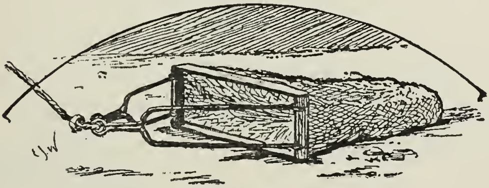
Audited and found correct,
ALFRED LEICESTER.

LIVERPOOL, *December* 31*st*, 1894.

Explanation of the Plates.

Plate I.—Chart of the Irish Sea showing the zones of depth (contours 10, 20, and 50 fathoms), the nature of the bottom (see p.), and the lines of distribution (thick dotting) of the drift bottles.

Plate II.—Calcareous "concretion," containing shells, sand grains, &c., cemented with carbonate of lime and a little carbonate of iron (see last report, p. 31). From a photograph by Rev. T. S. Lea.



L.M.B.C. NOTICES.

The public are admitted by ticket to inspect the Aquarium from 12 to 1 and from 6 to 6-30 p.m. daily, when the Curator will be, as far as possible, in attendance to give information. Tickets of admission, price sixpence each, to be obtained at the Biological Station or at the Bellevue Hotel. The various tanks are intended to be illustrative of the marine life of the Isle of Man. It is intended also that short lectures on the subject should be given from time to time by Prof. Herdman, F.R.S., the Hon. Director of the Station, or by other members of the Committee.

Applications to be allowed to work at the Biological Station, or for specimens (living or preserved) for Museums, Laboratory work, and Aquaria, should be addressed to Professor Herdman, F.R.S., University College, Liverpool.

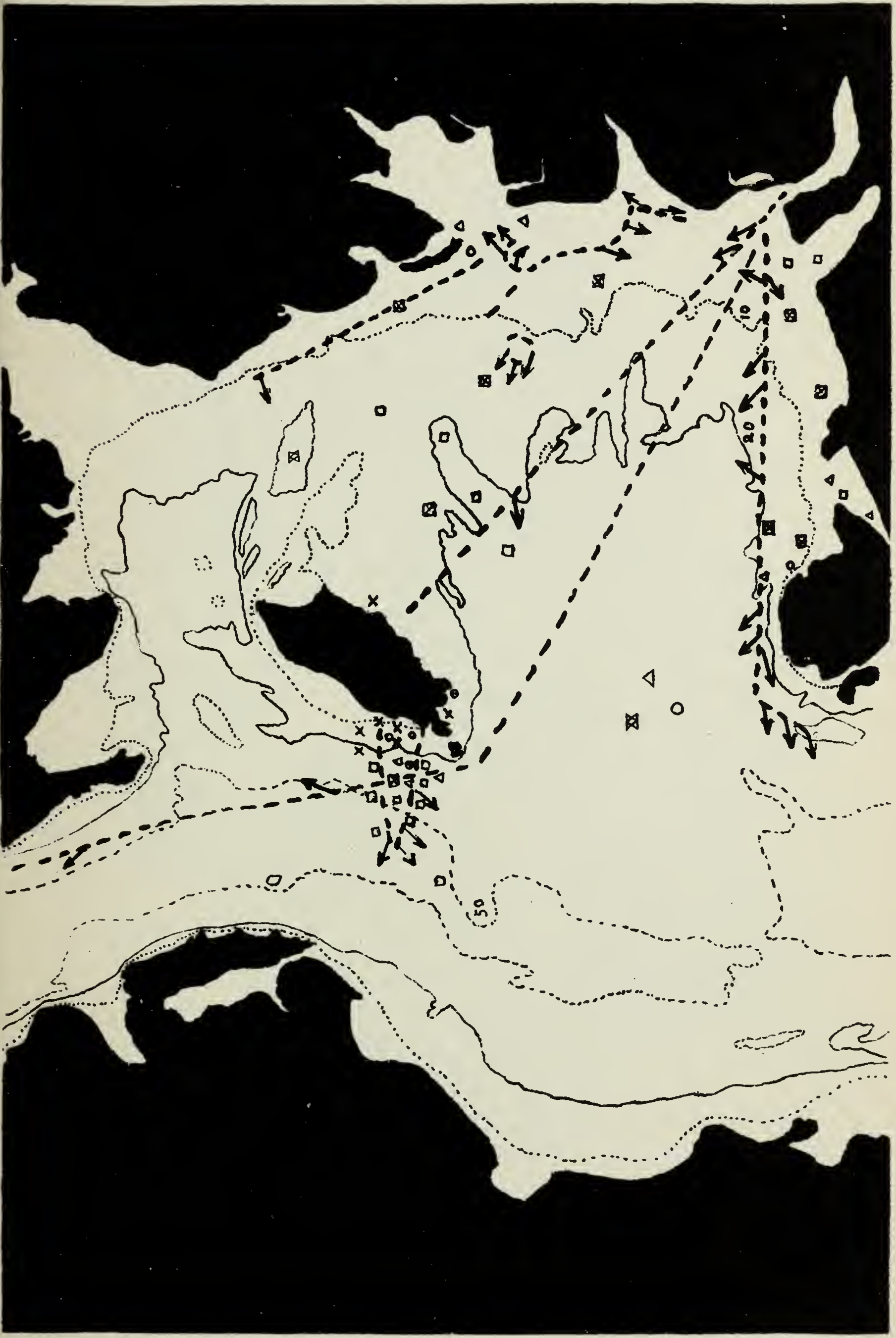
Subscriptions and donations should be sent to Mr. I. C. Thompson, F.L.S., 19, Waverley Road, Liverpool.

The L.M.B. Committee are publishing their Reports upon the Fauna and Flora of Liverpool Bay in a series of 8vo. volumes at intervals of about three years. Of these there have appeared :—

Vol. I. (372 pp., 12 plates), 1886, price 8/6.
Vol. II. (240 pp., 12 plates), 1889, price 7/6.
Vol. III. (400 pp., 24 plates), 1892, price 10/6.

Copies of these may be ordered from the Liverpool Marine Biology Committee, University College, Liverpool, or from the Hon. Sec., 4, Lord Street, Liverpool.

Isaac C. Thompson,
Hon. Sec. and Treas.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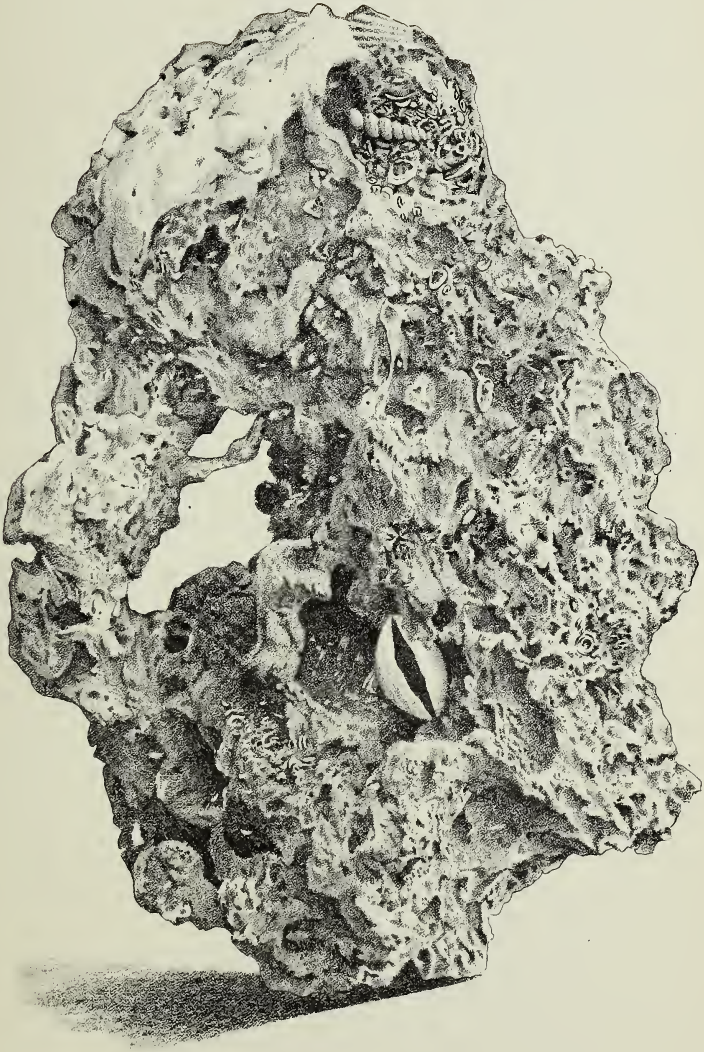

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Sugar-loaf Rock, near Spanish Head.